Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.914
*Biol. Clin. Sci. Res. J., Volume, **2024**: 914*
Original Research Article

QUALITATIVE STUDIES OF CREAM CHEESE MADE BY USING *BIFIDOBACTERIUM BIFIDUM* & *LACTOBACILLUS ACIDOPHILUS*

HUSSAIN A[1*], INAYAT S[2], AHMED F[1], RASHID S[1], REHMAN B[1], SAEED I[1]

[1]*School of Food Science & Technology, Minhaj University Lahore, Pakistan*
[2]*Department of Dairy Technology, University of Veterinary & Animal Sciences, Ravi Campus, Pattoki, Pakistan*
**Corresponding author email address: abidavenue@gmail.com*

(Received, 12th March 2024, Revised 7th June 2024, Published 17th June 2024)

Abstract *The world is facing a lot of health problems especially in underdeveloped countries of Asia. This crucial situation demands beneficial foods. This study was planned to produce quality Cream cheese. Probiotic Cream cheese has been promoted for health benefits by using Bifidobacterium bifidum & Lactobacillus acidophilus. Buffalo milk was used to produce Cream cheese. Five treatments were handled; T₀ was the regular treatment in which yoghurt culture was inoculated to make Cream cheese while a combination of yoghurt as well as Bifidobacterium bifidum & Lactobacillus acidophilus was inoculated in T1, T2, and T3. Besides T4 was produced by using only Bifidobacterium bifidum & Lactobacillus acidophilus. In the process milk was standardised up to 5% milk fat then it was pasteurized (63°C for 30 minutes). Cooled to 42°C and 2% starter culture was inoculated in that mixture. After incubation, the pH reached up to 4.6. Salt (0.5-1%) was added and the product was packed into plastic cups and stored (4°C, 4 weeks). A qualitative study of the product showed that T4 treatment was better as compared to T₀, T1, T2, and T3. Conclusively, probiotic Cream cheese produced by using buffalo milk is beneficial for reducing health problems like gastric problems, colon cancer, etc. This product can play a vital role in the functional foods industry as well as the cheese industry.*

Keywords*:* *Probiotic; Cream cheese; Health; Functional; Buffalo; Quality*

Introduction

Cream cheese can be defined as mild, rich, soft, and unripened cheese. It is a popular soft cheese in the world with a characteristic diacetyl flavor and aroma (USDA, 1994). Its appearance is creamy white and it is slightly acidic in taste. It is a very nutritious and useful product used as spreads on bagels, as salad dressings, and as a part of manufacturing some desserts, like cheesecakes (Phadungath, 2005). The basic mixture of Cream cheese is fortified up to 8 to 14 % fat intended for double Cream cheese; 3-5 % fat for single Cream cheese (Phadungath, 2005). During the past few years, the use of probiotics in foods has been widely promoted in the media due to its health claims. Normally cheeses with probiotic cultures received higher scores for bitterness, sour-acid taste, and vinegary taste as compared to non-probiotic cheeses (Karimi et al. 2012[a]). However it can be improved by using probiotic starter cultures such as *Lactobacillus acidophilus* & *Bifidobacterium bifidum* which are used in different dairy products.

Pakistan as the 4th largest milk-producing country has great potential to manufacture cheese products. A product group, that is expected to show strong growth in the future, is cheese (Fakhar and Walker, 2006). Cream cheese has a great floor to be entertained for this purpose as our milk-producing breeds have more fat percentages, especially buffalo and sheep, which is a desirable aspect for Cream cheese. As probiotic application of Cream cheese is a basic need of the dairy industry in Pakistan.

So, the present study was planned by incorporating *Lactobacillus acidophilus* & *Bifidobacterium bifidum* in Cream cheese by using buffalo milk. Besides this, control measures, sensory characteristics of probiotic cheese, and qualitative aspects of this product were also monitored. Alves et al. (2013) worked on Cream cheese by using *Lactobacillus acidophilus* (La-5), *Bifidobacterium animalis* (Bb-12), and inulin. They used different concentrations of above mentioned probiotic bacteria to check the stability of Cream cheese. Different physicochemical parameters were observed including pH, fat, protein, and total solids contents also viable cell counts were observed after different intervals of 1, 15, 30, and 45 days at refrigerated storage. As a result, the Cream cheese appeared as a suitable food medium for probiotic bacteria in particular *Bifidobacterium animalis*. Great work was done on Cream cheese by Phadungath (2005) who

[Citation: Hussain, A., Inayat, S., Ahmad, F., Rashid, S., Rehman, B., Saeed, I. (2024). Qualitative studies of cream cheese made by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus*. *Biol. Clin. Sci. Res. J.*, **2024***:* 914. doi: https://doi.org/10.54112/bcsrj.v2024i1.914]

reviewed Cream cheese and its products. Cream cheese has characteristics of soft; acid-coagulated cheese products; fermented by mesophilic lactic starter cultures, for example, *Leuconostoc* & *Lactococcus*. It was first manufactured by the cooked-curd method and then cold-pack & hot-pack methods were developed. The most significant textural property of Cream cheese is the spread-ability. A good job was done by Brighenti et al. (2008) who studied the textural, rheological, and sensory properties of commercial US Cream cheese with different fat contents. Rheological properties were analyzed at a heating range of 5-80°C. The spreadability and hardness of Cream cheeses were measured by a texture analyzer.

Materials & Methods

Purchase of Raw Material

Raw buffalo milk was collected from the University of Veterinary & Animal Sciences, B-Block (Dairy Animals Training & Research Centre), Ravi Campus.

Starter Culture

To prepare yoghurt, a starter culture was obtained from Nestle Pakistan Pvt. Ltd., Lahore.

Probiotic culture

Probiotic culture was purchased from SAAF International (general traders), main Boulevard Defense, Lahore.

Analysis of Milk

Total solids, titratable acidity, and ash contents were determined according to the methods (AOAC, 2000).

pH

pH was determined by using a digital pH meter (WTW, Series-inoLab, pH-720) by using the methods (AOAC, 2000).

Fat contents

Fat contents were determined by Gerber method (James, 1995).

Protein contents

The protein contents of milk were determined according to the method of the British Standards Institute (BSI, 1990) by using Kjeldahl apparatus.

Lactose contents

The lactose content of milk was determined by the difference

Lactose % = TS % - (Fat % +Protein % +Ash %)

Solids not fat contents

Solids not fat contents of milk were determined by the difference

SNF % = TS % -Fat%

Production/Processing steps for Probiotic Cream cheese

The following steps were adopted to produce Cream cheese.

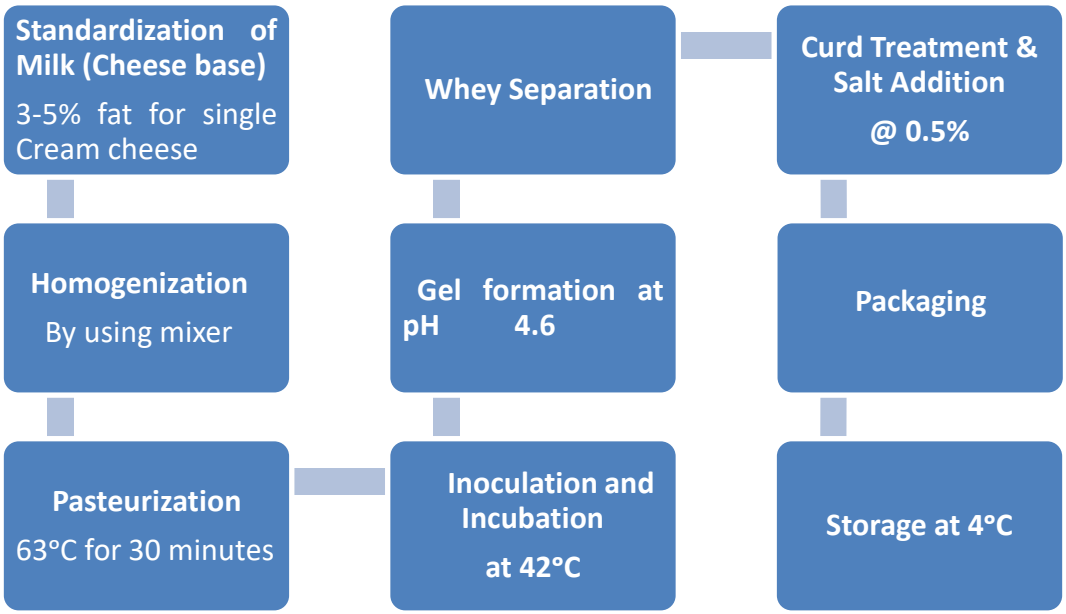

Figure-1: Steps to make Cream Cheese

Reference: Kosikowski and Mistry, 1999; and Lucey, 2003.

Standardization of milk for Cream Cheese

Cheese milk was standardized with 5% fat for single Cream cheese. 0.4% gelatine was also added.

Homogenization

The ingredients were incorporated and mixed with the help of a kitchen mixer (Philips, HR2027/75/AC). A homogeneous and plain creamy mixture was formed at the end.

Pasteurization

The mixture was pasteurized at 63°C for 30 minutes.

Cooling

The mixture was cooled to 42°C for incubation.

[Citation: Hussain, A., Inayat, S., Ahmad, F., Rashid, S., Rehman, B., Saeed, I. (2024). Qualitative studies of cream cheese made by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus*. *Biol. Clin. Sci. Res. J.*, **2024***:* 914. doi: https://doi.org/10.54112/bcsrj.v2024i1.914]

Inoculation

After pasteurization of the standardized mixture and cooling the starter culture was added at the rate of 2%. Probiotic culture was employed for direct vat inoculation.

Incubation

Then the vat was allowed to set at 42°C until a pH of 4.6 was achieved.

Curd Treatment

After firm curd was formed, it was diced with the help of knives in small cubes and waited for 15 minutes for whey separation.

Whey Separation

Curd was transferred to the muslin cloth and retained for 14 hours at the refrigeration temperature (4°C).

Addition of Salt and other Additives to the Curd

Next day the curd was homogenized with the help of a mixer (Philips, HR2027/75/AC) after the addition of 0.5% salt.

Packaging

Cream cheese was filled into plastic cups of 200mL and stored at refrigeration temperature (4°C) for 4 weeks and sampled every week for physico-chemical analysis.

Table-1: Experimental plan

Treatments	Yoghurt culture	Probiotic culture
To (Control)	0.04 uc	-
T_1	0.03 uc	0.01 uc
T_2	0.02 uc	0.02 uc
T_3	0.01 uc	0.03 uc
T_4	-	0.04 uc

Physico-chemical Quality Analysis

The moisture content was obtained in a forced air-drying oven at 105°C aimed at 16 hours. Ash was determined gravimetrically, burning on a muffle furnace at 550°C. Protein content in Cream cheese was determined by using the Kjeldahl method followed by multiplying the results of nitrogen content with a factor of 6.38. Moreover, fat was determined by using the Gerber method while carbohydrates were calculated by difference. pH was measured by a digital pH meter and acidity in terms of lactic acid was determined by titration method (AOAC, 2000).

Microbiological Quality Analysis

Yeast, Molds, and Coliforms counts were performed (APHA, 2001) along with a shelflife study.

Storage Study

The products were stored at 4ºC for 4 weeks. Textural properties of Cream cheese made from buffalo milk, with different concentrations of probiotic culture used, were analyzed at 1st, 7th, 14th, 21^{st,} and 28th days of storage.

Sensory Analysis

Sensory attributes (i.e. aroma, appearance, flavor and taste, texture, and mouth feel) were studied according to the procedure described by Meilgard et al. (1987).

Statistical Analysis

An experiment was planned in a completely randomized design; the collected data was evaluated by a two-way analysis of variance (Steel et al., 1997), to find the effects of treatments and storage on the Cream cheese quality. Significant difference among the treatments was made by using Duncan's Multiple Range test (DMR). SAS 9.1 was used for statistical analysis.

Results & Discussion

This study aimed to manufacture Cream cheese by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus* and to perform qualitative tests for safe consumption by the consumer. So, the following are the results of physicochemical, microbiological as well as sensory tests of this Cream cheese during storage.

Physicochemical parameters

Fat percentage

Cream cheese has been divided into different types on the base of fat percentage. Results indicated that treatments T0, T2, and T4 were not significantly different in fat percentage ranging between 10.23% - 11.09% while T1 and T3 were significantly different in fat percentage. On the other hand, during the first 3 weeks, the fat percentage of Cream cheese was not significantly different but it showed a change in the last week of storage. These results resemble the study of (Phadungath, 2005) who concluded that higher fat contents gave a firmer texture to the Cream cheese.

Moisture contents

Moisture contents of Cream cheese were examined on 1st, 7th, 14th, 21st as well as the 28th days of storage. Mean moisture and standard deviations of different treatments T_0, T1, T2, T3, and T4 have been shown below in table M-1 while in table M-2 analysis of variance results has been shown. Moisture contents are very important for the textural properties as well as the spread-ability of Cream cheese. Normal moisture contents in Cream cheese range from 70-80%. During the storage of Cream cheese T0 and T3 were not significantly different in moisture contents while T1 and T2 also showed the same behavior regarding moisture contents. But T4 had an exceeding value of moisture contents at 81.97%. Among the days, the mean value of moisture contents in Cream cheese was not significantly different during the first 3 weeks. While 1st and 28th day's moisture contents were not significantly different. The moisture contents of the product resembled those of (Olmedo et al. 2013) who studied the chemical properties of flavored cheese in which moisture contents were 71g/100g i.e. 71%.

[Citation: Hussain, A., Inayat, S., Ahmad, F., Rashid, S., Rehman, B., Saeed, I. (2024). Qualitative studies of cream cheese made by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus*. *Biol. Clin. Sci. Res. J.*, **2024***:* 914. doi: https://doi.org/10.54112/bcsrj.v2024i1.914]

Protein contents

Cream cheese contains milk proteins including caseins and whey proteins. These proteins play their role as emulsifiers moreover they make Cream cheese a nutritious product for consumers. The normal protein contents in Cream cheese range between 12-14%. During storage days the protein contents of Cream cheese remained significantly unchanged for T0, T2, and T4. T1 and T3 treatments were not significantly different in proteins. According to the days' mean values, there was no significant difference during 4 weeks of storage but 7th day had a different value of 11.70%. These contents indicated the good nutrition of Cream cheese in this study. These protein contents resembled commercial smooth Cream cheese i.e. 12.7 ± 0.12% analyzed by (Sainani et al. 2004) during the characterization of particles in Cream cheese.

Microbiological parameters

The microbial quality of Cream cheese is the most important aspect. For the safety of consumers, it was checked for yeast & molds as well as coliform count. The study showed that yeast and molds were not significantly different in T1, T2, and T4, while T0 and T3 had the same results. During storage days yeast & molds had not significantly different results. Coliforms remained absent (<10 cfu/g) during all storage periods. Overall this Cream cheese appeared good for consumption within the shelf life period according to the following table because overall acceptability depends upon the physicochemical as well as microbiological quality of the product.

Table SL-1: Shelf life estimation of Cream cheese

Treatments	Manufacturing Date	Best before	Expected Shelf life
T₀	22-03-2014	12-04-2014	3 weeks
T1	19-02-2014	19-03-2014	4 weeks
T2	20-02-2014	20-03-2014	4 weeks
T3	24-03-2014	14-04-2014	3 weeks
T4	24-032014	21-04-2014	4 weeks

Sensory study

A sensory study of T4 prepared by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus* has been shown in Table SS-5. It indicated that Cream cheese prepared from probiotic starter culture had more reliable and beneficial sensory effects and improved quality as compared to the Cream cheese made from the usual yoghurt culture.

Table F-1: Fat means and standard deviations

	Day 1 (A)	Day 7 (B)	Day 14 (C)	Day 21 (D)	Day 28 (E)	Treatments Mean
T₀	11.13 ± 0.18	11.17 ± 0.17	10.8 ± 0.15	11.33 ± 0.17	11 ± 0.29	11.09^{c} ± 0.09
T1	13.72 ± 0.12	13.42 ± 0.22	14.47 ± 0.26	14.17 ± 0.17	7.47 ± 0.26	12.65^{b} ± 0.70
T2	10.23 ± 0.15	10.17 ± 0.17	10.47 ± 0.26	10.83 ± 0.17	9.47 ± 0.26	10.23^{c} ± 0.14
T3	14.23 ± 0.15	14.4 ± 0.1	14.27 ± 0.1	14.5 ±0	14.4 ± 0.21	14.36^{a} ± 0.06
T4	10.3 ± 0.15	10.63 ± 0.13	10.47 ± 0.26	10.83 ± 0.17	10.33 ± 0.17	10.51^{c} ± 0.09
Days Mean	11.92^{a} ± 0.46	11.96^{a} ± 0.45	12.09^{a} ± 0.50	12.33^{a} ± 0.44	10.53^{b} ± 0.61	

Means with the same letters are not significantly different.

Table F-2: Two way analysis of variance for fat

Source	DF	SS	MS	F-value	P-value
Model	24	285.07	11.88	110.66	<.0001
Treatments	4	178.26	44.57	415.21	<.0001
Days	4	30.14	7.54	70.21	<.0001
Treatments*Days	16	76.67	4.79	44.64	<.0001
Error	50	5.37	0.11		

[Citation: Hussain, A., Inayat, S., Ahmad, F., Rashid, S., Rehman, B., Saeed, I. (2024). Qualitative studies of cream cheese made by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus*. *Biol. Clin. Sci. Res. J.*, **2024***:* 914. doi: https://doi.org/10.54112/bcsrj.v2024i1.914]

Corrected total	74	290.44				

Table M-1: Moisture contents means and standard deviations

	Day 1 (A)	Day 7 (B)	Day 14 (C)	Day 21 (D)	Day 28 (E)	Treatments Mean
T₀	71.13 ± 0.09	71.59 ± 0.17	71.69 ± 0.09	71.68 ± 0.07	71.43 ± 0.22	71.51^{c} ± 0.08
T1	86.63 ± 0.07	71.61 ± 0.06	70.04 ± 0.03	70.24 ± 0.14	80.74 ± 0.02	75.85^{b} ± 1.79
T2	76.81 ± 0.02	76.85 ± 0.02	76.73 ± 0.12	76.43 ± 0.12	79.13 ± 0.04	77.19^{b} ± 0.26
T3	72.35 ± 0.01	72.35 ± 0.03	72.37 ± 0.01	72.38 ± 0.06	72.34 ± 0.02	72.36^{c} ± 0.01
T4	86.5 ± 0.12	80.37 ± 0.09	81.43 ± 0.12	81 ± 0.63	80.57 ± 0.29	81.97^{a} ± 0.62
Days Mean	78.69^{a} ± 1.79	74.55^{b} ± 0.94	74.45^{b} ± 1.10	74.35^{b} ± 1.05	76.84^{a} ± 1.09	

Means with the same letters are not significantly different.

Table M-2: Two way analysis of variance for moisture contents

source	DF	SS	MS	F-value	P-value
Model	24	1818.80	75.78	923.23	<.0001
Treatments	4	1054.96	263.74	3213.01	<.0001
Days	4	223.39	55.84	680.37	<.0001
Treatments*Days	16	540.44	33.78	411.49	<.0001
Error	50	4.10	0.08		
Corrected total	74	1822.91			

Table SS-5: Sensory evaluation of T4

	Day 1	Day 7	Day 14	Day 21	Day 28
Aroma	Butter smell	Butter/a little acidic smell	Butter/a lot acidic smell	Butter/a lot acidic smell	Butter smell/a lot acidic smell
Appearance	A little yellowish/A lot glossiness	A little yellowish	A little yellowish/ glossiness	A little yellowish/ glossiness	A little yellowish
Flavor/Taste	Buttermilk flavor/salty taste	Buttermilk flavor/ salty taste	Buttermilk flavor/A little salty taste	Buttermilk flavor/A little salty taste	Buttermilk flavor/A little salty taste
Texture/ Mouth-feel	Smooth texture/ A little fatty after mouth-feel	Smooth texture/ A little fatty after mouth-feel	Smooth texture/ A little fatty after mouth-feel	Smooth texture/ A little fatty after mouth-feel	Smooth texture/ A little fatty after mouth-feel
Spreadability	Good	Good	Good	Good	Good

Conclusion

A good quality Cream cheese was produced from buffalo milk by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus.* Qualitative study indicated that probiotic Cream cheese had a better shelf life and sensory attributes as compared to the Cream cheese produced from yoghurt culture. This product enhances the beneficial effects for its consumers, as probiotic strains used in this study ultimately increase the age of their consumers. Pakistan dairy industry has a great scope to produce Cream cheese according to this study due to the availability of huge amounts of buffalo milk.

References

Alves LL, Richards NSPS, Mattanna P, Andraded DF, Rezer APS, Milani LIG, Cruz AG, Faria JAF. 2013. Cream cheese as a symbiotic food carrier using Bifidobacterium animalis Bb-12 and Lactobacillus acidophilus La-5 and inulin. *Int J Dairy Technol*. **66**: 63-69.

[Citation: Hussain, A., Inayat, S., Ahmad, F., Rashid, S., Rehman, B., Saeed, I. (2024). Qualitative studies of cream cheese made by using *Bifidobacterium bifidum* & *Lactobacillus acidophilus*. *Biol. Clin. Sci. Res. J.*, **2024***:* 914. doi: https://doi.org/10.54112/bcsrj.v2024i1.914]

AOAC. 2000. Official Methods of Analysis. 17th ed. Association of Official Analytical Chemists, Washington (DC).

APHA. 2001. Compendium of methods for the microbiological examination of foods. American Public Health Association, Washington (DC). 676.

Brighenti M, Govindasamy-Lucey S, Lim K, Nelson K, Lucey JA. 2008. Characterization of the rheological, textural, and sensory properties of samples of commercial US cream cheese with different fat contents. *J Dairy Sci*. **91**(12): 4501-17.

BSI. 1990. In Determination of Nitrogen Content of Liquid Milk. Methods for Chemical Analysis of Liquid Milk and Cream. BSI 1741, British Standards Institute. London. UK.

Fakhar H, Walker G. 2006. The White Revolution " Dhoodh Darya". White Paper on Pakistan's Dairy Sector; [cited 2013 Nov 02]. Available from: http://www.pddc.com.pk/DairyPakistan-Publication.pdf

James CS. 1995. Determinatuion of Fat Contents of Dairy Products by Gerber Method. Analytical Chemistry of Food Blackie Academic and Professional, an imprint Chanpman and Hall. Glasgow. (UK). p. 93-95.

Karimi R, Sohrabvandi S, Mortazavian AM. 2012[a]. Review Article: Sensory Characteristics of Probiotic Cheese. *Compr Rev Food Sci Food Saf*. **11**: 437-452.

Kosikowski FV, Mistry VV, Virginia LLC. 1999. Bakers', Neufchatel, cream, quark, and ymer, in Cheese and fermented milk foods, procedures and analysis. **2**: 42-55.

Lucey JA. 2003. Acid and acid/heat coagulated cheese. Encyclo dairy sci. (ed Roginski H, Fuquay JW, Fox PF). Academic Press, London. 1: 350-356.

Meilgard M, Civille QV, Carr BT. 1987. Sensory Evaluation Techniques. ORC Press, Boca Raton. Florida. 1.

Olmedo RH, Nepote V, Grosso NR. 2013. Preservation of sensory and chemical properties in flavoured cheese prepared with cream cheese base using oregano and rosemary essential oils. LWT - Food Sci Technol. 53: 409-417.

Phadungath C. 2005. Cream cheese products: A review. *Songkla J Sci Technol*. **27**(1): 191-199.

Steel RGD, Torrie JH, Dickei DA. 1997. Principles and Procedure of Statistics A Biometric Approach. 3rd ed. Mc. Graw Hill Book Co. Statistics. New York. USA.

Sainani MR, Vyas HK, Tong PS. 2004. Characterization of Particles in Cream Cheese. *J Dairy Sci*. **87**: 2854-2863.

United States Department of Agriculture-USDA. 1994. USDA Specifications for cream cheese, cream cheese with other foods, and related products; [cited 2013 Nov 02]. Available from: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELDEV3004555

Declaration

Ethics Approval and Consent to Participate

Not applicable.

Consent for Publication

The study was approved by authors.

Funding Statement

Not applicable

Conflict of Interest

There is no conflict of interest among the authors regarding this case study.

Authors Contribution

All authors contributed equally.